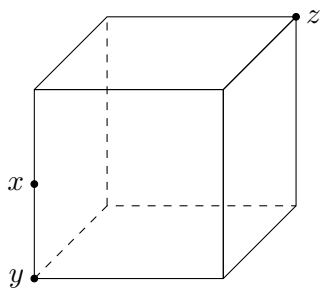
Shortest Paths on Polyhedra

Math 282 Computational Geometry

1. Consider a unit cube:



(a) What is the shortest path on the surface of the cube from x to z?

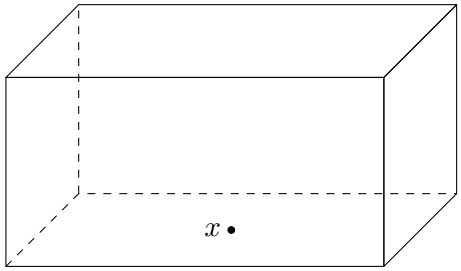
(b) What is the shortest path on the surface of the cube from y to z?

(c) Does the shortest path between any two points ever touch the interior of at least 5 faces?

(d) Does the shortest path ever go through a vertex?

(e) Place a point p in the middle of one face. Find the set of points on the opposite face that have more than one shortest path to p.

2. Now consider a $2 \times 1 \times 1$ box:



Let x be midpoint of one face of the box, as shown. What is the set of points on the box that have more than one shortest path to x?